ESSENTIAL PLANT FOOD ELEMENTS

A radio talk by Dr. Oswald Schreiner, Bureau of Chemistry and soils, delivered through Station KOA, Denver, Colo., and 35 other stations associated with the National Broadcasting Company, June 11, 1930.

Many of you who are now listening to this farm and home hour program of the National Broadcasting Company will recall that only a few weeks ago I had the opportunity of talking to you from Washington on the subject "Making the Most of Fertilizers." If there was then any doubt as to your interest in fertilizers it was entirely dispelled by your response. From every State in the Union, from farmers and ranchers, truck growers and orchardists - yes, even housewives and city gardeners - there came requests for copies of the talk or for further information on some special point.

Hundreds of letters and cards came in to the Department of Agriculture and to nearly forty radio stations broadcasting the farm and home hour program. The record-breaking response indicated your appreciation of the fertilizer experiments and studies made by the U. S. Department of Agriculture and by the many State experiment stations.

But, it did more than that. It fully convinced me that American farmers, certainly the more progressive ones, are concerned about the fertility of their fields, that they are eager to know more about plant foods and that they see in commercial fertilizers an able ally in their fight to reduce production costs and thus increase the profits and satisfaction in farming.

With your permission, I am going to repeat a statement in that radio talk. "The proper use of fertilizer is one of the best ways, under present cost of production, to increase your farm income. Labor is high, and in general increased acreage is not as economically advisable as increased acre production. Your interest, taxes, cultural operations, and seed must be taken care of before your profit is assured.

An acre of underfed plants, struggling for growth and reproduction, means no more, probably less, than an average yield, the price of which is absorbed to meet the foregoing items of expense. If any profit is to result, a higher yield must be secured.

It is therefore better to produce a high and profitable yield on less acreage than an average yield on the full acreage. This is true of all crops As far as fertilizer is concerned, there is as much economy in taking food away from your field plants, expecting them to yield well on what they can get from the soil alone, as there would be to curtail the food of your animals below maintenance requirements."

Please notice that I said "It is better to produce a high and profitable yield on less acreage than an average yield on the full acreage." This is only another way of saying "Fewer Acres with Greater Profit" which may suggest a course of action to many farmers who are struggling under the burden of great labor expense on too large an acreage, high costs of production per bushel or pound, and narrow margin of profit, or none at all.

Every farmer, every orchardist, every gardener is what one might call a manufacturing chemist, for in growing plants he converts the chemical elements of the soil, air and water into living plant tissue or crops; into starch and sugar; into fat and oil; into protein and fiber; a process far more wonderful and elaborate than can be found in the most intricate manufacturing processes of chemist or engineer.

The use of fertilizers reduced to its simplest form is nothing more or less than man's effort to aid and cooperate with nature in supplying the chemical elements required by growing plants. Hence, the kinds of chemical plant foods, the amounts of each per acre and the proportions of the different elements in the fertilizer are prime factors in their scientific and profitable use.

Scientists have found that there are at least 20 chemical elements that enter into the make-up of growing plants and yet only three of these elements have as yet assumed any large importance so far as commercial fertilizer is concerned. These three, as you all know, are nitrogen, phosphorus and potassium.

Fully 99 per cent of the nearly 8 million tons of commercial fertilizer used annually by farmers of the United States are sold on the basis of their guaranteed percentage contents of these three elements in available forms. The reason is that practically all of the soils of this country that are not naturally fertile, are relatively deficient in one or two or all of these three elements and tend to become more so with continued farming.

It is, however, concerning some of the less common or rarer plant food elements that I want to say a few words at this time. First, let me add that the old established plant food triumvirate - nitrogen, phosphorus and potassium - are the only ones that can be economically applied to soils, so far as we now know. Nevertheless, there are a number of other elements in soils that are absolutely essential to the normal growth and fruition of plants but which, in too large quantities, may be positively injurious.

Some of these rarer elements vitally affect the health and well-being not only of plants but of animals and human beings that use them as foods. Let us consider a few of them very briefly.

Manganese, more popularly thought of in connection with the manufacture of certain qualities of steel and iron, has been found to be an essential element in plant growth and so lacking in certain soils as to practically prevent plant development. The use of manganese in fertilizers has come about in recent years as the result of practical demonstrations on certain crops in southern Florida.

These demonstrations were based on research work by scientists of the Department of Agriculture whose work over a period of years shows that lack of manganese produced symptoms analogous to disease conditions. This element is widely distributed throughout the soils of this country but in certain sections there is little of it or it is in a form not available to plants.

I should add a word of caution against too promiscuous a use of manganese, for not only is this uneconomic, but a too liberal supply will cause harmful results.

Everyone is familiar with ordinary copper but how many of you think of it as an element essential to growing plants? Practically all soils are thought to have sufficient copper for crop needs but certain abnormal ones, like the peat lands of the Florida Everglades, require application of copper for profitable production. This is applied in the form of copper sulphate so well known to many farmers as blue vitriol or "blue stone" commonly used in the preparation of spray materials.

You are all familiar with borax of which the principal constituent is boron. Yet few know that this element is now known to be essential, in very minute quantities, to normal plant growth and development. It is especially necessary in helping the legume bacteria to fix nitrogen, a truly remarkable system of cooperation between plant, bacteria and boron. However, practically all soils have enough boron and its possible use in fertilizers is a problem of the future rather than the present.

I do not want to leave the subject without pointing out to you the tremendous value to human and animal life and freedom from disease of the presence of some of these elements in the food we eat and the feed we give to our stock.

Iodine is essential to prevent the dreaded goitre in man and abortion in cattle and hairlessness in young pigs; copper and manganese play their part in the formation of blood and the prevention of anemia, and it has been shown that these constituents are wisely stored up in the unborn child or animal to enable it to function properly until it can get its supply later in its food, since mother's milk or cow's milk does not supply these essential elements at the start.

As you know, liver which contains copper compounds is now being prescribed even for pernicious anemia; and low calcium and phosphorus content cause many serious diseases in cattle. Numerous other illustrations might be cited.

The best and normal way to supply these elements, as well as the other essential mineral elements, to animals and to man is through their feed and food, through plants, vegetables, and fruits, grown on fertile well-fertilized soils.

Since I am speaking to you here from Denver in the heart of the sugar beet territory I want to say a few words to my sugar beet friends in Colorado, Nebraska, Iowa, North Dakota and Minnesota, whose hearty cooperation has made our experimental work in their territory successful.

Fertilizers are new to this region but they are being used to a considerable extent now and on many of the soils the application of fertilizer is giving handsome returns. The response to fertilizers high in phosphates or to superphosphate alone is fairly characteristic of the soil regions in

which sugar beets are grown.

The value of these experiments is emphasized by the low cost of the plant food element most needed and by the results to be obtained from as small an application of fertilizer as 125 to 200 lbs. of superphosphate per acre. The cost of the fertilizer to the grower is less than three dollars per acre and with an average increase of three tons of sugar beets at seven dollars per ton the additional profit is about eighteen dollars per acre, as much as the total value of a good wheat crop.

It is quite generally recognized that phosphate stimulates root development more perhaps than any other one factor. Phosphorus is one of the most essential of the chemical elements required by all living matter. It is closely associated with life and growth, since it is a constituent part of every living cell. When new cells are formed by division as is the case in growing roots, the phosphorus is divided between the new cells and hence a new supply has to be provided by the soil and fertilizer to maintain growth.

When the soil fertility work of the U. S. Department of Agriculture was started in the Arkansas Valley in 1922 no fertilizer was used commercially on sugar beets in Colorado, the largest and most profitable sugar beet territory of the United States. From a single car load in 1923, following our experimental demonstration of profitable results, the tonnage of fertilizer used has steadily grown throughout the sugar beet territory as the result of the work of the U.S. Department of Agriculture, the State experiment stations and the beet sugar and fertilizer companies.

No definite information is available at this time to show the acreage of sugar beets that is fertilized this season, but it has been estimated at from two to three hundred thousand acres which at only an average increase of three tons of beets per acre will increase the value of this year's crop by about five million dollars.

Under present economic conditions, phosphate, in the form of 16 to 20 per cent superphosphate and 40 to 48 per cent treble superphosphate, is being used, but as time proceeds the other fertilizer constituents, potash and nitrogen, will doubtless also have to be included. In some of the soils we have studied, such a complete fertilizer as it is called, even now gives the best returns when the sugar content is also considered.

The fertilizer requirements of beet soils, like all other soils, is a dynamic question and changes with the passing years, so that continued vigilance and research are necessary if the most practical results are to continue to be obtained. For this reason experiments will have to be conducted on all of the main soil types on which sugar beets are grown in order that we may give definite recommendation and advice on fertilizer matters and guide the farmer in the purchase of plant food materials that will net him the largest possible returns on his investment.